PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Hisashi WATANABE, et al.

Appln. No.: 09/361,118

Confirmation No.: 5143

Filed: July 27, 1999

Docket No: Q55086

Group Art Unit: 1731

Examiner: C. FIORILLA

For: ALUMINA SINTERED BODY AND PROCESS FOR PRODUCING THE SAME

SUBMISSION OF APPELLANT'S BRIEF ON APPEAL

Commissioner for Patents
Washington, D.C. 20231

Sir:

Submitted herewith please find an original and two copies of Appellant's Brief on Appeal. A check for the statutory fee of $320.00 is attached. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account. A duplicate copy of this paper is attached.

Respectfully submitted,

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APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the provisions of 37 C.F.R. § 1.192, Appellants submit the following:

I. REAL PARTY IN INTEREST

The real party in interest is Sumitomo Chemical Company, Limited, of Osaka Japan.

II. RELATED APPEALS AND INTERFERENCES

There are no other related appeals and interferences.

III. STATUS OF CLAIMS

Claims 1 to 12 are all of the claims that have been presented.

Claims 9 to 12 have been subjected to a restriction requirement and have been withdrawn from further consideration.

Claims 1 to 8 have been rejected and are the claims on appeal.

IV. STATUS OF AMENDMENTS

There were no amendments to the claims that were presented after final rejection.

V. SUMMARY OF THE INVENTION

The present invention relates to a process for producing a polycrystalline alumina sintered body which comprises the steps of preparing a slurry by subjecting alumina powder and a solvent to ultrasonic irradiation, mechanical stirring not using a grinding medium, or ultrasonic irradiation and mechanical stirring not using a grinding medium, to provide a slurry of alumina dispersed in a solvent. Page 4, line 19 to page 5, line 1; page 10, lines 11 to 13, page 12, lines 6 to 12. The slurry is dried and formed to produce a green body. Page 5, lines 2 to 3; page 45, line 7 of original claim 1. The green body is then sintered in an air atmosphere at a temperature in the range of 1400°C to 1800°C. Page 5, lines 4 to 5.

The alumina powder has a purity of 99.99 wt% or more, and comprises α alumina particles having substantially no fractured surface. Page 5, lines 7 to 8 and page 6, lines 5 to 7. The alumina powder exhibits specific properties. Page 5, lines 8 to 19. The alumina powder has an average particle size of 0.1 μm or more to 1.0 μm or less. Page 5, lines 14 to 16 and page 6, lines 17 to 18.

VI. ISSUES

The issue on appeal is whether the Examiner was correct in rejecting claims 1 to 8 under 35 U.S.C. § 103 as obvious over Mohri et al in view of Huang or Ali et al.

VII. GROUPING OF CLAIMS

The claims stand or fall together.

VIII. ARGUMENTS

Appellants submit that the rejection of claims 1 to 8 under 35 U.S.C. § 103(a) as obvious over Mohri et al in view of either Huang or Ali et al should be reversed.

The present invention relates to a process for producing a polycrystalline alumina sintered body which comprises the steps of preparing a slurry by subjecting alumina powder and a solvent to ultrasonic irradiation, mechanical stirring not using a grinding medium, or ultrasonic irradiation and mechanical stirring not using a grinding medium, to provide a slurry of alumina dispersed in a solvent. The slurry is dried and formed to produce a green body. The green body is then sintered in an air atmosphere at a temperature in the range of 1400°C to 1800°C.

As set forth in claim 1, the alumina powder has a purity of 99.99 wt% or more, and comprises α alumina particles having substantially no fractured surface. Claim 1 sets forth specific properties for the alumina powder, including a particle size of 0.1 to 1.0 μm.

In essence, the Examiner has argued that Huang and Ali et al disclose mixing a slurry of powder and solvent by ultrasonic energy, and argues that in view of the teaching at column 6, line 31 of Mohri et al that the mixing in Mohri et al can be carried out in any conventional manner, it would have been obvious to employ an ultrasonic mixing to make the slurry in Mohri et al.

Both Huang and Ali et al disclose employing ultrasonic mixing to make a slurry. Appellants submit, however, that one of ordinary skill in the art would not have been led to combining the teaching of these references with Mohri et al because their technical fields are much different from each other and they do not relate to the same art.

In particular, according to Mohri et al, the main object of the invention is to provide an alumina composition which provides, on sintering, an alumina ceramic having wrap resistance and high dimensional precision. See column 2, lines 5-8.

On the other hand, the object of the invention disclosed in Ali et al is to provide an improved packaging material for use with electronic devices. See column 2, lines 9-20. The Ali et al patent is directed to making an alumina nitride/aluminum composite, and does not relate to making alumina slurries.

Further, the invention disclosed in Huang is directed to a method for producing a sintered reaction bonded silicon nitride composite which is reinforced with silicon carbide whiskers, which contains silicon nitride particles, or both. Thus, the Huang patent is directed to a silicon nitride composite containing silicon carbide whiskers or silicon nitride powders, and does not have anything to do with making alumina slurries.

Appellants submit that the inventions described in these references provide different materials or devices with different features. Accordingly, one of ordinary skill in the art would not have had any motivation to combine the teachings of these references.

With respect to appellants' argument that one of ordinary skill in the art would not have combined the teachings of Huang and Ali et al with those of Mohri et al because they do not relate to the same art, the Examiner has argued that all of these references relate to ceramic materials. More particularly, the Examiner has argued that the references relate to the mixing of slurries of ceramic materials and, therefore, they all relate to the same art, that is, the art of mixing ceramic slurries.

Appellants submit that this argument of the Examiner is not well founded because it is an over simplification to state that all of the references relate to the same art of mixing ceramic slurries. The references, in fact, relate to making different compounds by different reactions.

Mohri et al relate to making an alumina composition, Ali et al relate to making an aluminum nitride/aluminum composite, and Huang relates to a silicon nitride composite. Since the references relate to different compounds, applicants submit that they do not relate to the same art, and that one of ordinary skill in the art would not have been led to combining them.

Further, the primary particle size of the aluminum nitride powder used in Ali et al is about 38 μm (passing through a 400 mesh opening size 0.0015 inch, as disclosed at column 4, lines 3 to 15), and the primary particle size of powdered silicon (a nonmetallic element) used by Huang is not greater than 5 μm, as disclosed at column 2, lines 29 to 30. (In Example 1, Huang discloses powdered silicon having an 8 μm particle size as a raw material, which is then dry milled to obtain silicon powder having a 4μm average particle size (range 2 to 20 μm)). These particle sizes are much different from each other. While the primary particle size of the alumina powder in Mohri et al (0.1 to 5 μm, as disclosed at column 5, lines 58 to 60) at the lower end of its range may be similar to the primary particle size of the alumina that is used in the present invention (0.1 to 1 μm), the primary particle size of the different powders used in Ali et al or Mohri et al are much different from each other. Further, the primary particle size disclosed in Huang relates to a nonmetallic element (silicon) and not a metal-containing compound which is either the aluminum nitride of Ali et al or the alumina (aluminum oxide) of Mohri et al. Accordingly, these prior inventions use different raw materials.

In view of the above, appellants submit that there is no motivation to combine the teachings of either Huang or Ali et al with Mohri et al.

In summary, the references do not relate to that same art, and one of ordinary skill in the art would not have been led to combining the teachings of these references.

Turning now to the statement in Mohri et al that conventional mixing can be used, this statement refers to conventional methods of mixing alumina slurries. Mohri et al describe two such methods, namely, ball mill or a vibration mill, each of which involves a grinding. Thus, Mohri et al, at column 6, lines 30 to 32 and at lines 60 to 62, state that "Mixing of α-alumina and the other components can be carried out in a conventional manner, for example, by means of a ball mill or a vibration mill". According to this description, a ball mill or a vibration mill are the conventional methods of mixing α-alumina. Appellants submit that is was not conventional to mix alpha alumina by ultrasonic mixing.

Mohri et al, at column 4, lines 14-15, does refer to "ultrasonication", but this description relates to a method for mixing transition alumina and seed crystal to produce α-alumina and not for dispersing α-alumina to prepare a slurry. Appellants submit that these descriptions in Mohri et al support appellants' position that Mohri et al do not teach or imply ultrasonic irradiation as a conventional method for dispersing α-alumina.

With respect to appellants' argument that it was not conventional to mix alpha alumina by ultrasonic mixing, the Examiner has asserted that arguments of counsel cannot take the place of evidence, and that the disclosure in Mohri et al of specific mixing processes do not limit the broad statement in Mohri et al that mixing can be carried out in a conventional manner.

In response, appellants submit that the burden is on the Examiner to show that it was conventional to mix alpha alumina by ultrasonic mixing, rather than on appellants to show that it

was not conventional to mix alpha alumina by ultrasonic mixing. The Examiner has not provided any evidence to support his position that it was conventional to mix alpha alumina by ultrasonic mixing. Rejections cannot be based on unsupported assertions by the Examiner.

One of the purposes of employing the ultrasonic mixing in the present invention, as disclosed at page 10 of the present specification, is to reduce the formation of aggregates. The Huang patent, at column 3, lines 23 to 25, discloses that ultrasonic vibration breaks down agglomerates.

As described at page 10 of the present specification, the alumina powder used as a raw material in the present invention contains such a small amount of agglomerates, and such uniform particle shape and particle size, that the alumina powder can be dispersed to form a uniform slurry only by irradiating with ultrasonic wave. It is also well known that the mixing methods using grinding media have higher energy to reduce the formation of agglomerates than an irradiation with ultrasonic wave. Thus, even if Huang discloses ultrasonic irradiation to reduce the formation of agglomerates, it does not mean that it is obvious to replace the mixing methods using the grinding media in Mohri et al with the ultrasonic mixing technique of Huang because Huang does not disclose or teach the alumina powder used in the present invention that contains small amount of agglomerates and has a uniform particle shape and the particle size recited in claim 1. Further, Huang merely discloses the use of an ultrasonic mixer.

With respect to appellants' argument that even though Huang discloses ultrasonic irradiation to reduce the formation of agglomerates, this disclosure does not mean it would have been obvious to replace the mixing methods using the grinding media in Mohri et al with the

ultrasonic mixing technique of Huang because Huang does not teach the alumina powder employed in the present invention and merely discloses the use of an ultrasonic mixer, the Examiner has argued that he is citing Huang for a teaching of a mixing method and not a teaching of the materials. The Examiner has asserted that Mohri et al call for conventional mixing, not grinding, and Huang clearly teaches a mixing technique.

In response, since Mohri et al describe that the conventional mixing is done by mixing techniques that employ grinding, appellants maintain that the conventional mixing in Mohri et al refers to mixing that employs grinding techniques. Moreover, contrary to the Examiner's assertion, the mixing method cannot be divorced from the materials that are being mixed.

Additionally, as can be seen from the discussion of particle sizes set forth above, the particle size used by Mohri et al may be much smaller (0.1 μm) than that used by Huang or by Ali et al. Alumina powders having a large particle size, such as the 4 μm size in Huang or the 38 μm size in Ali et al (which are sizes for particles other than alumina), may be somehow well dispersed by ultrasonic irradiation because such an alumina powder has a weak force to agglomerate, but a smaller particle size has a stronger force to agglomerate. A small particle size, such as of less than 1 μm as recited in the present claims, is usually considered to be difficult to well disperse by a weak pulverizing power such as ultrasonic irradiation.

If α-alumina is not dispersed in a slurry, the density of a sintered body obtained by calcining a green body produced by the slurry does not increase, and a high density sintered body like that of the present invention cannot be obtained.

Huang and Ali et al are silent about whether ultrasonic irradiation can be applied to a small particle size powder of 0.1 to 1 μm to obtain a well-dispersed slurry. Moreover, neither Huang nor Ali et al teach or imply the effect of application of ultrasonic irradiation to small particle size powder. Accordingly, even if Huang or Ali et al are combined with Mohri et al, it may, somehow render obvious a method for mixing transition alumina and seed crystal by ultrasonic irradiation to produce α-alumina, but it would not render obvious a method for dispersing α-alumina to prepare a slurry by ultrasonic irradiation.

In view of the above, appellants submit that there is no motivation to combine Mohri et al with Ali et al or Huang, much less to replace the mixing methods using the grinding media in Mohri et al with the ultrasonic mixing technique of Huang or Ali et al.

The Examiner further has stated that the recitation in the claims that the particles have substantially no fractured surface covers the presence of a single particle having no fractured surface. The Examiner has stated that "it is notoriously well known in the art that during mixing or milling some particles are unchanged and thus no fractured surfaces exist".

As regards substantially "no fractured surface", appellants submit that the Examiner misunderstands the recitations of the present claims. According to the present invention, the particles having substantially no fractured surface are the alumina powder used as a raw material, and are not particles that have been mixed or milled in the steps that occur after the step of preparing the slurry. Thus, it is irrelevant whether some particles are unchanged during mixing or milling.

One of the features of the present invention is to use alumina powder comprising polyhedral particles having substantially no fractured surface. The alumina powder employed in the present invention mainly includes polyhedral powders having substantially no fractured surface. The presence of a single particle having substantially no fractured surface would not satisfy the recitations of the present claims.

By using such specific alumina powder as set forth in claim 1, appellants can achieve the present invention.

Additionally, by using alumni powder comprising particles having substantially no fractured surface, the alumina powder is prevented from secondary agglomeration in the steps after the step of preparing the slurry.

With respect to appellants' arguments concerning the fact that appellants employ particles having substantially no fractured surface, the Examiner has stated that Mohri et al disclose, at columns 4 to 5, a method of preparing the alumina powder that is used in the Mohri et al process. The Examiner has stated that Mohri et al disclose that after these powders are prepared, there may be some instances where the powder are subjected to simple grinding, as disclosed at column 5, line 35. The Examiner has stated that this refers to the powder before the slurry is prepared.

In response, appellants submit that the disclosure at column 5, line 35 of Mohri et al does not satisfy the recitations of the present claims of employing a powder having substantially no fractured surface. Mohri et al, at column 5, line 35, do not state that these powders have substantially no fractured surface. Appellants submit that the burden is on the Examiner to

establish that Mohri et al contain a disclosure of the use of powders having substantially no fractured surface.

Further, in the experiments disclosed in Mohri et al, alumina powder was subjected to a ball milling. That is, alumina powder was dry blended, so that the alumina powder had fractured surfaces before preparing the slurry.

In view of the above, appellants submit that the cited prior art does not disclose or suggest the use of an alumina powder having substantially no fractured surface.

In view of the above, appellants submit that there is no motivation to combine Huang or Ali et al with Mohri et al, and that even if there is, the present invention is not obvious over Mohri et al in view of Huang or Ali et al.

In view of the above, appellants submit that the present invention is not obvious over Mohri et al in view of either one of Ali et al or Huang and, accordingly, request reversal of this rejection.

The present Brief on Appeal is being filed in triplicate. Unless a check is submitted herewith for the fee required under 37 C.F.R. §1.192(a) and 1.17(c), please charge said fee to Deposit Account No. 19-4880.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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Date: August 29, 2002

APPENDIX

CLAIMS 1-8 ON APPEAL:

1. A process for producing a polycrystalline alumina sintered body which comprises the steps of:

preparing a slurry by subjecting alumina powder and a solvent to ultrasonic irradiation, mechanical stirring not using a grinding medium, or ultrasonic irradiation and mechanical stirring not using a grinding medium, to provide a slurry of alumina dispersed in a solvent;

drying and forming said slurry to produce a green body; and then

sintering said green body in an air atmosphere at a temperature in the range of 1400°C to 1800°C.

wherein said alumina powder has a purity of 99.99 wt% or more and comprises a polyhedral particle having substantially no fractured surface, and comprises α alumina particles having polyhedral shape; a D/H ratio of from 0.5 or more to 3.0 or less, wherein D represents a maximum particle diameter parallel to the hexagonal lattice plane of a hexagonal close packed lattice of α alumina, and H represents a maximum particle diameter perpendicular to the hexagonal lattice plane of a hexagonal close packed lattice of α alumina; the number-average particle size of from 0.1 μm or more to 1.0 μm or less; a D90/D10 ratio of 7 or less, wherein D10 and D90 are the particle sizes at 10% cumulation diameter and 90% cumulation diameter, respectively, from the smallest particle side in a cumulative particle size distribution.

2. The process according to claim 1, wherein an alumina powder in mixture with a sintering agent is subjected to ultrasonic irradiation, mechanical stirring not using a grinding

medium, or ultrasonic irradiation and mechanical stirring not using a grinding medium, to provide a slurry of alumina dispersed in a solvent.

3. The process according to claim 1, wherein the maximum diameter of pores in said polycrystalline alumina sintered body is 10 μm or less, the number of said pores from 0.1μm or more to 10 μm or less. per one mm^2 is 20 or less, said alumina purity is 99.99 % or more, and the density of said sintered body is 3.970 g/cm^3 or more.

4. The process according to claim 2, wherein the maximum diameter of pores in said polycrystalline alumina sintered body is 10 μm or less, the number of said pores of from 1 μm or more to 10 μm or less per one mm^2 is 10 or less, said alumina purity is 99.99 % or more, and the density of said sintered body is 3.975 g/cm^3 or more.

5. The process according to claim 2, wherein said sintering agent is added to said alumina powder in an amount of from 10 ppm or more to 2000 ppm or less in terms of oxide.

6. The process according to claim 2, wherein said sintering agent is added to said alumina powder in an amount of from 10 ppm or more to 70 ppm or less in terms of oxide.

7. The process according to claim 2, wherein said sintering agent is at least one compound selected from the group consisting of alkaline earth metal compounds and silicon compounds.

8. The process according to claim 2, wherein said sintering agent is a magnesium compound.